GEORGIA INSTITUTE OF TECHNOLOGY — OFFICE OF CONTRACT ADMINISTRATION

PROJECT ADMINISTRATION DATA SHEET

[x] ORIGINAL [ ] REVISION NO. _____

Project No. A-3301 DATE 7/30/82

Project Director: Victor K. Tripp School/Lab ECSL

Sponsor: Hays International Corporation

Type Agreement: Purchase Order No. 903297

Award Period: From 7/21/82 To ~~11/21/82~~ ~~9/31/83~~ 5/15/83 (Performance) _____ (Reports)

Sponsor Amount: $11,316 Contracted through:

Cost Sharing: _____ GTRI/GTEx

Title: PSR-2 Antenna Analysis

ADMINISTRATIVE DATA

OCA Contact Faith G. Costello

1) Sponsor Technical Contact:

Walt Pearson
Hays International Corp.
Targets Division
P.O. Box 707
Leeds, AL 35094

2) Sponsor Admin/Contractual Matters:

Gayle Throckmorton
Hays International Corp.
Targets Division
P. O. Box 707
Leeds, AL 35094
205-699-6151

Defense Priority Rating: N/A

Security Classification: N/A

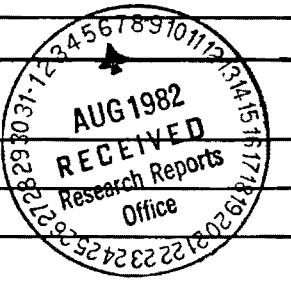
RESTRICTIONS

See Attached N/A Supplemental Information Sheet for Additional Requirements.

Travel: Foreign travel must have prior approval – Contact OCA in each case. Domestic travel requires sponsor approval where total will exceed greater of $500 or 125% of approved proposal budget category.

Equipment: Title vests with sponsor

COMMENTS:



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Computer Input
Project File
Other _____

GEORGIA INSTITUTE OF TECHNOLOGY OFFICE OF CONTRACT ADMINISTRATION

SPONSORED PROJECT TERMINATION SHEET

RM 454-20

Date 6/6/83

Project Title: PSR-2 Antenna Analysis

Project No: A-3301

Project Director: Victor K. Tripp

Sponsor: Hays International Corporation

Effective Termination Date: 5/15/83

Clearance of Accounting Charges: 5/15/83

Grant/Contract Closeout Actions Remaining:

- [x] Final Invoice ~~and Closing Documents~~
- [ ] Final Fiscal Report
- [ ] Final Report of Inventions
- [ ] Govt. Property Inventory & Related Certificate
- [ ] Classified Material Certificate
- [x] Other Certification of delivery

Assigned to: ECSL/EED (School/Laboratory)

COPIES TO:

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FORM OCA 10:781

Georgia Institute of Technology
ENGINEERING EXPERIMENT STATION
ATLANTA, GEORGIA 30332

9 September 1982

Mr. Walt Pearson
Hayes International Corporation
Targets Division
P. O. Box 707
Leeds, Alabama 35094

Dear Mr. Pearson:

Enclosed are the sketches that are required as the first deliverable under Hayes P. O. 903297. This final design yielded about 12 dBi gain at $\pm 20^{o}$ and more than 15 dBi on boresight. Of course, there will be some losses in the real antenna and in the radome. VSWR remained under 2:1 at 30 MHz from the design frequency. I do not consider that figure to be secure, but I do not think bandwidth will be a problem. At this frequency the gain at 20^{o} dropped about ¼ dB.

Since I did not exceed 13 dBi gain at $\pm 20^{o}$, I believe it would be wise to do a modicum of development during the measurements. In particular, various element lengths should be investigated. Therefore, I suggest that Hayes should not finalize the formal drawings until after the measurements. In addition, it may be prudent to fabricate more than three prototype antennas, at least if you want some to be returned unmodified.

The sketches are intended to present the complete antenna design, but not the interface with your pod. Any devices used to attach the board to the radome should be small, nearly lossless and, of course, non-metallic. Bulkhead attachments are not critical, but I would like to review your design of them also. The tolerance of the dimensions is indicated by the number of significant figures. If you find any dimensions inconvenient (or doubtful), please do not hesitate to call me. Some are critical, but some can be changed.

I am convinced that we squeezed all the performance we could out of this space for an antenna so simple. If you would like to review the research I went through to obtain this design, I would be happy to discuss it with you or to send you a copy of some of my notes. I have kept careful records even though Tech is not required to report them.

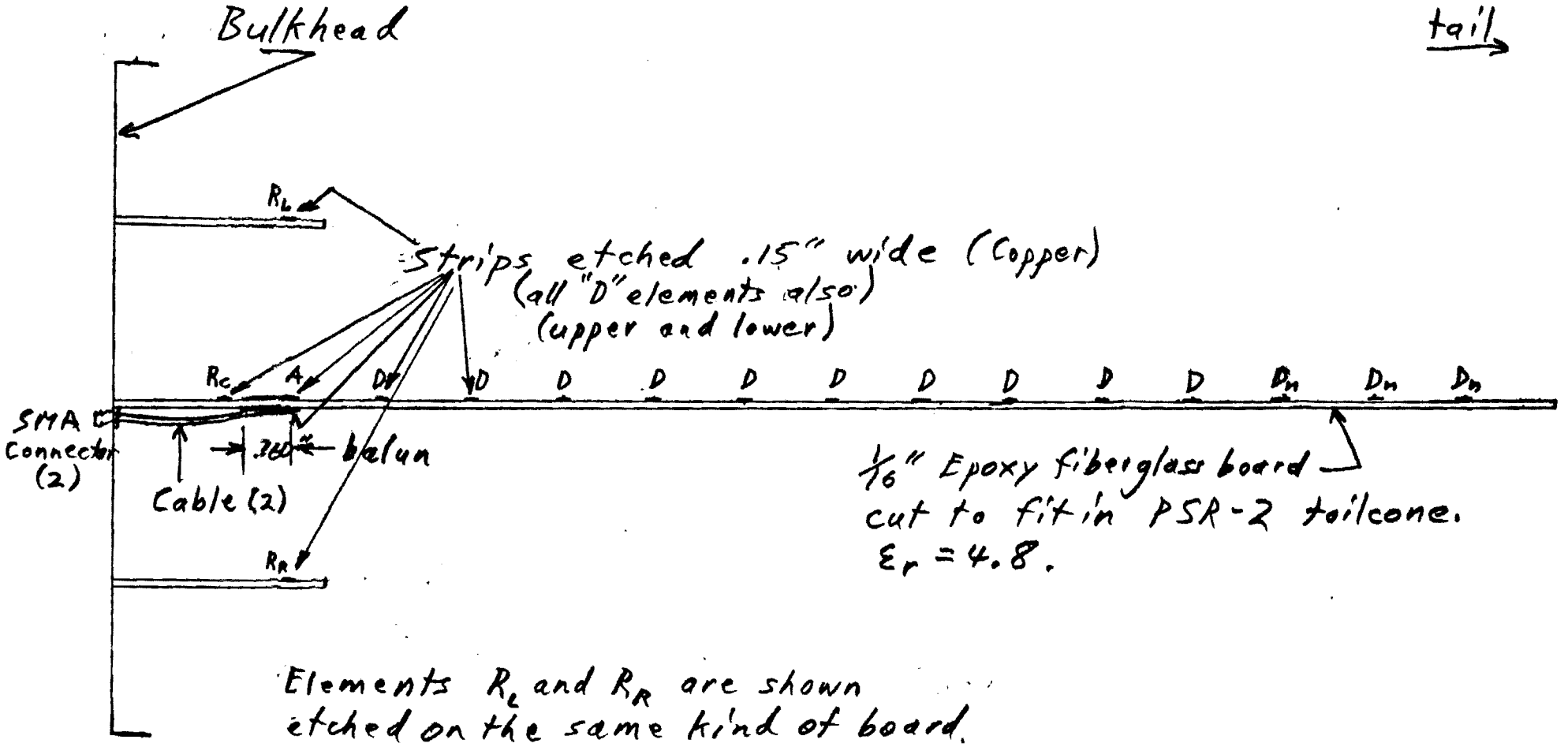
If the antennas are received within a few weeks, I can probably schedule their testing on fairly short notice. I look forward to seeing them.

Sincerely yours,

Victor K. Tripp
Project Director

Approved:

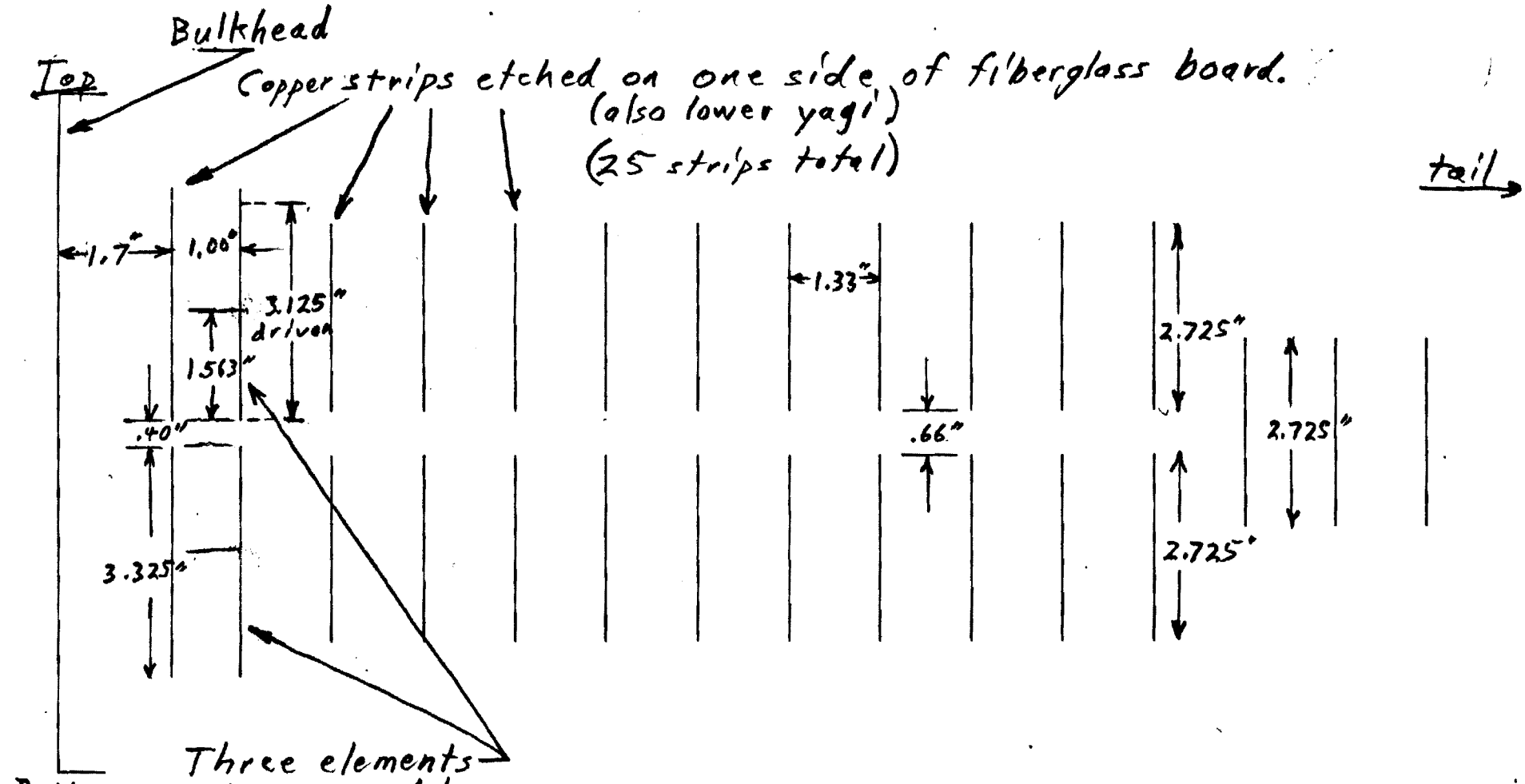
Charles E. Ryan, Jr.
Chief,
EM Effectiveness Division



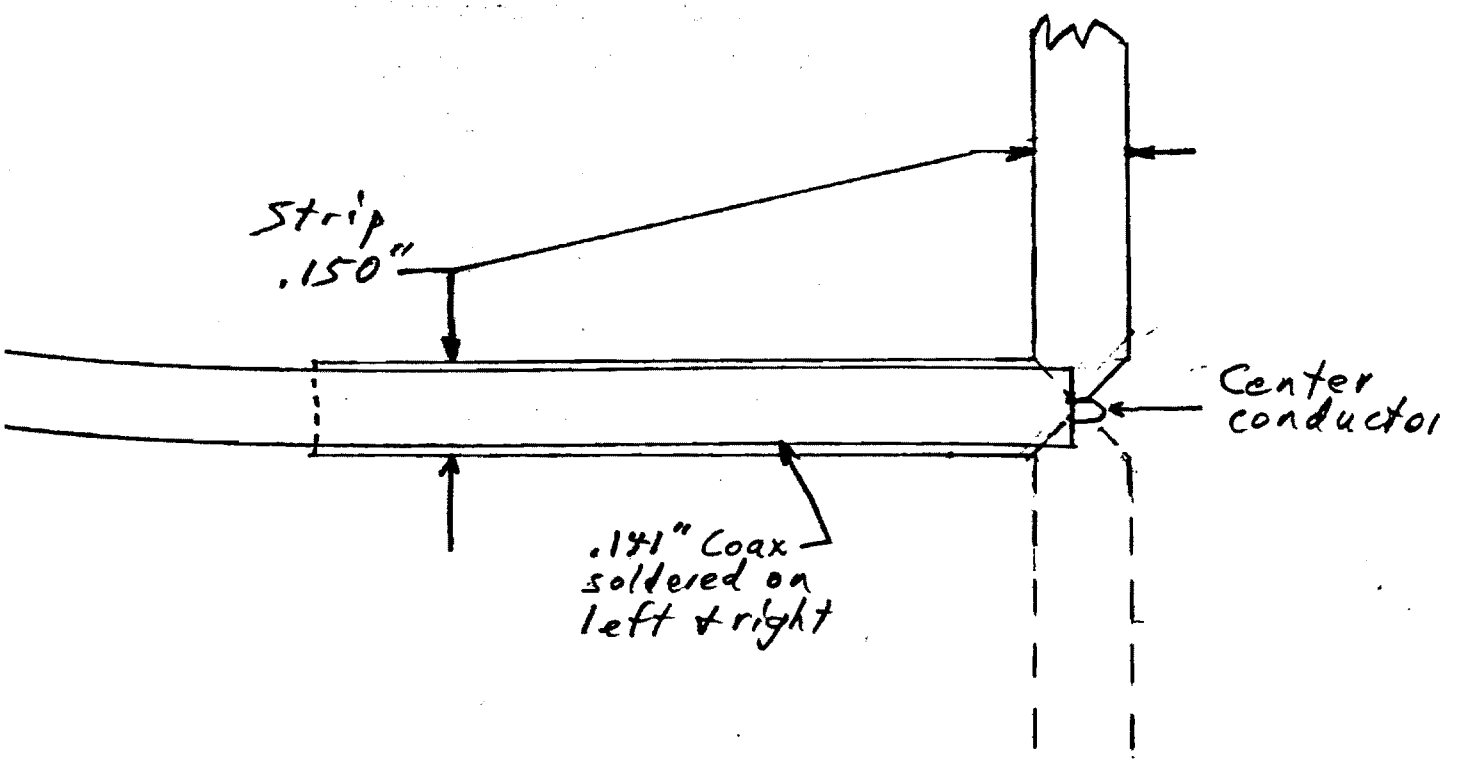
Elements R_L and R_R are shown etched on the same kind of board. Their may be better ways to support them. Size and shape are not critical. Length and position are critical.

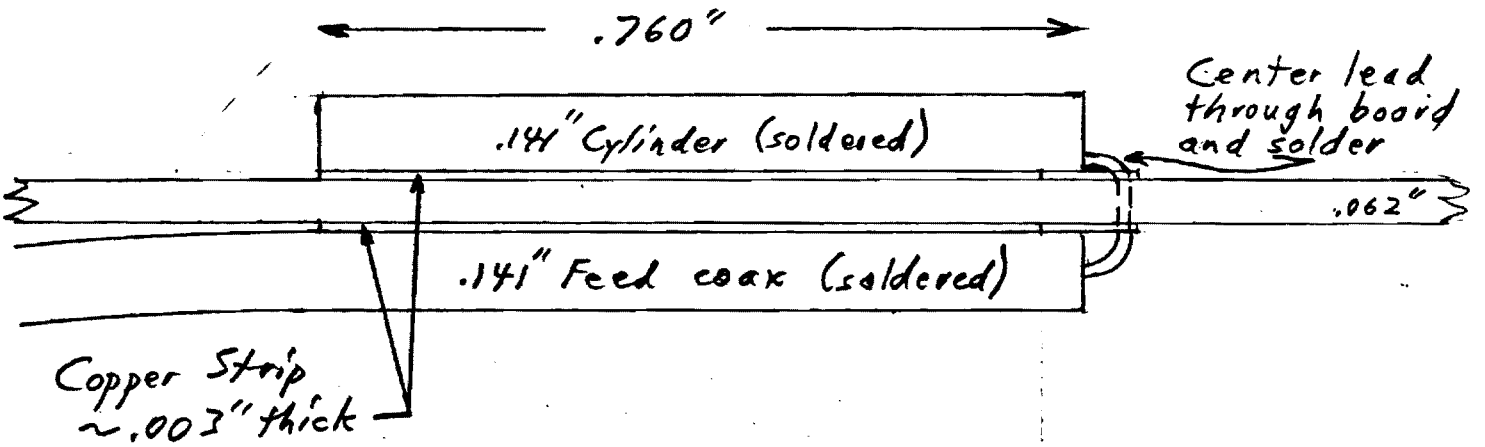
A coaxial power divider is needed in addition to the SMA connectors. (Triangle Microwave YL-22 or equivalent)

ANTENNA TOP VIEW (SCHEMATIC)



ANTENNA SIDE VIEW (SCHEMATIC)





BALUN DETAIL (SCHEMATIC)

ENGINEERING EXPERIMENT STATION
Georgia Institute of Technology
A Unit of the University System of Georgia
Atlanta, Georgia 30332

6 May 1983

Hayes International Corporation
Targets Division
P. O. Box 707
Leeds, Alabama 35094

Attention: Mr. Walt Pearson

Reference: Purchase Order No. 903297
(Georgia Tech Project A-3301)

Title: "PSR-2 Antenna Analysis"

Subject: Pattern Measurements

Gentlemen:

A copy of the radiation and reflection measurements performed on this project are enclosed herewith as the final deliverable item under the referenced Purchase Order. They include the principal plane pattern measurements and the reflection measurements of Antennas SN-001 and SN-002 in the radome assembly that Hayes provided. In addition, Figure 3 shows some experimental patterns measured without the side reflectors, in order to determine their effect.

Antenna 001 has a slight asymmetry in the E-plane (vertical) pattern. This is probably due in some way to the feed; either the power divider is not perfectly balanced or a connector produced some reflection. In any case, it should not have any impact on the performance of your system.

The gain levels were carefully measured for Antenna 001, and those printed are rounded to the nearest half dBi. The actual measurements were all within 0.2 dB of those recorded on the patterns. Cursory measurements were also made on Antenna 002 sufficient to confirm the measurements on Antenna 001.

A very minor mechanical design change is suggested. The antenna ports protrude through the bulkhead beyond the flange around its parameter. They may, therefore, be bent or damaged if a technician should carelessly rest the assembly on its bulkhead (its only flat surface). We suggest shorter coaxial leads on the antenna board, to preclude this possibility.

The sharp null in the antenna reflection measurement is not significant. As expected, there was no anomalous pattern behavior at this point. It is probably due to two reflections of similar magnitude that happen to cancel just at that frequency.

Georgia Tech believes this antenna design will be very producible, and will easily satisfy your performance requirements for it. We enjoyed serving you in the development of this antenna and look forward to similar business with you in the future.

Respectfully submitted,

Victor K. Tripp
Project Director

Approved:

Charles E. Ryan, Jr.
Chief,
EM Effectiveness Division

Enclosure

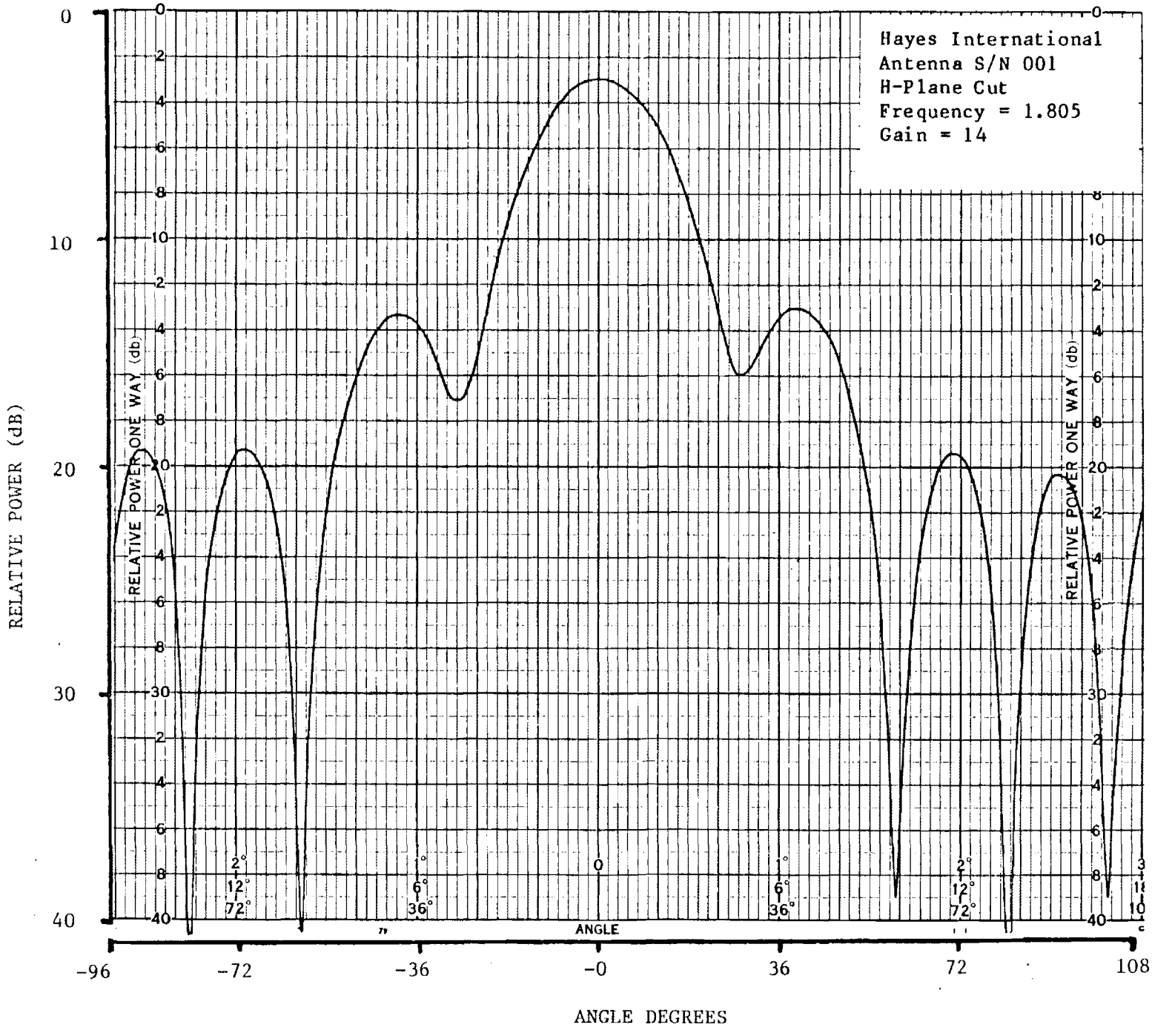


Figure 1. Antenna pattern for the Hayes S/N 001 antenna.

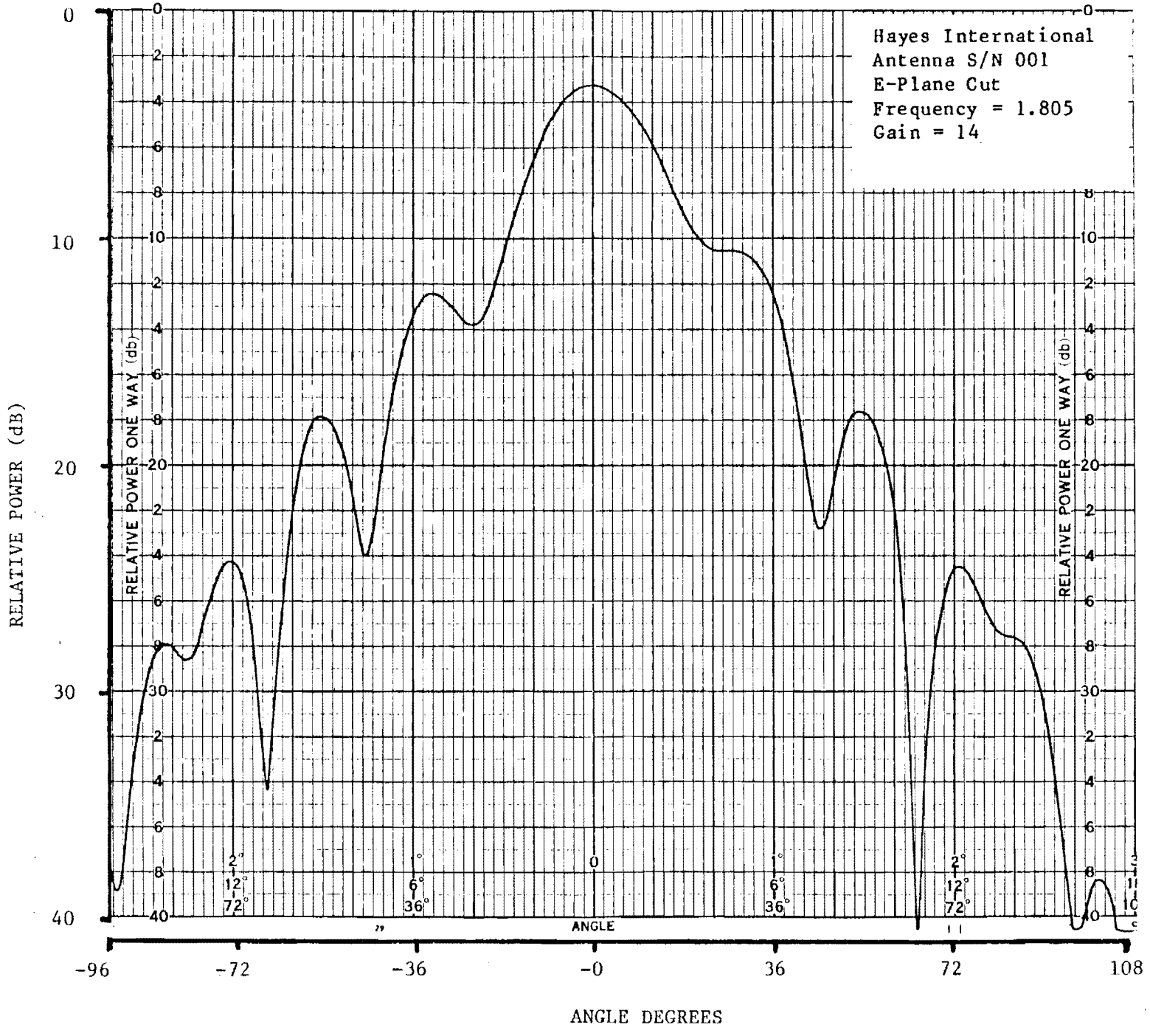


Figure 1. Antenna pattern for the Hayes S/N 001 antenna (continued).

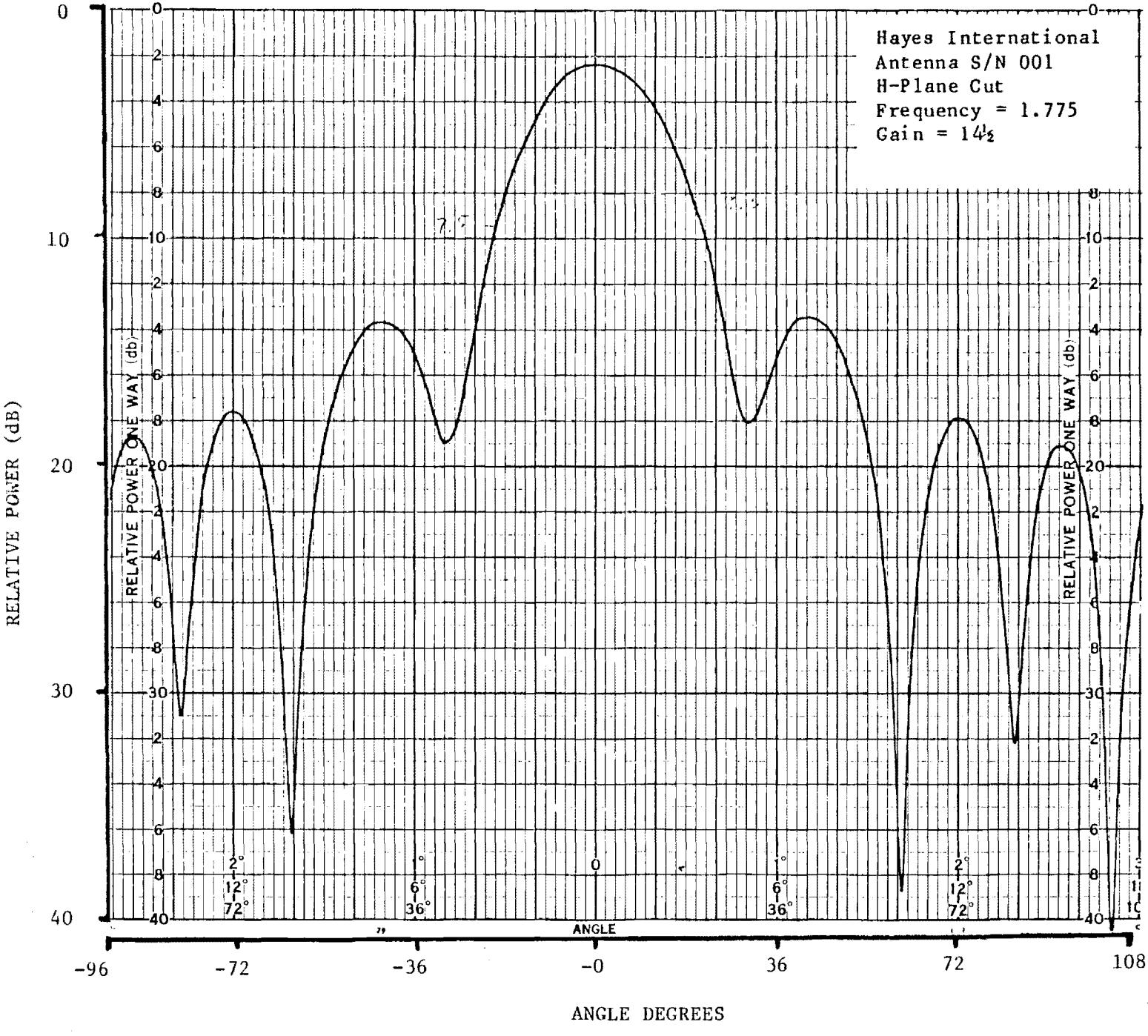


Figure 1. Antenna pattern for the Hayes S/N 001 antenna (continued).

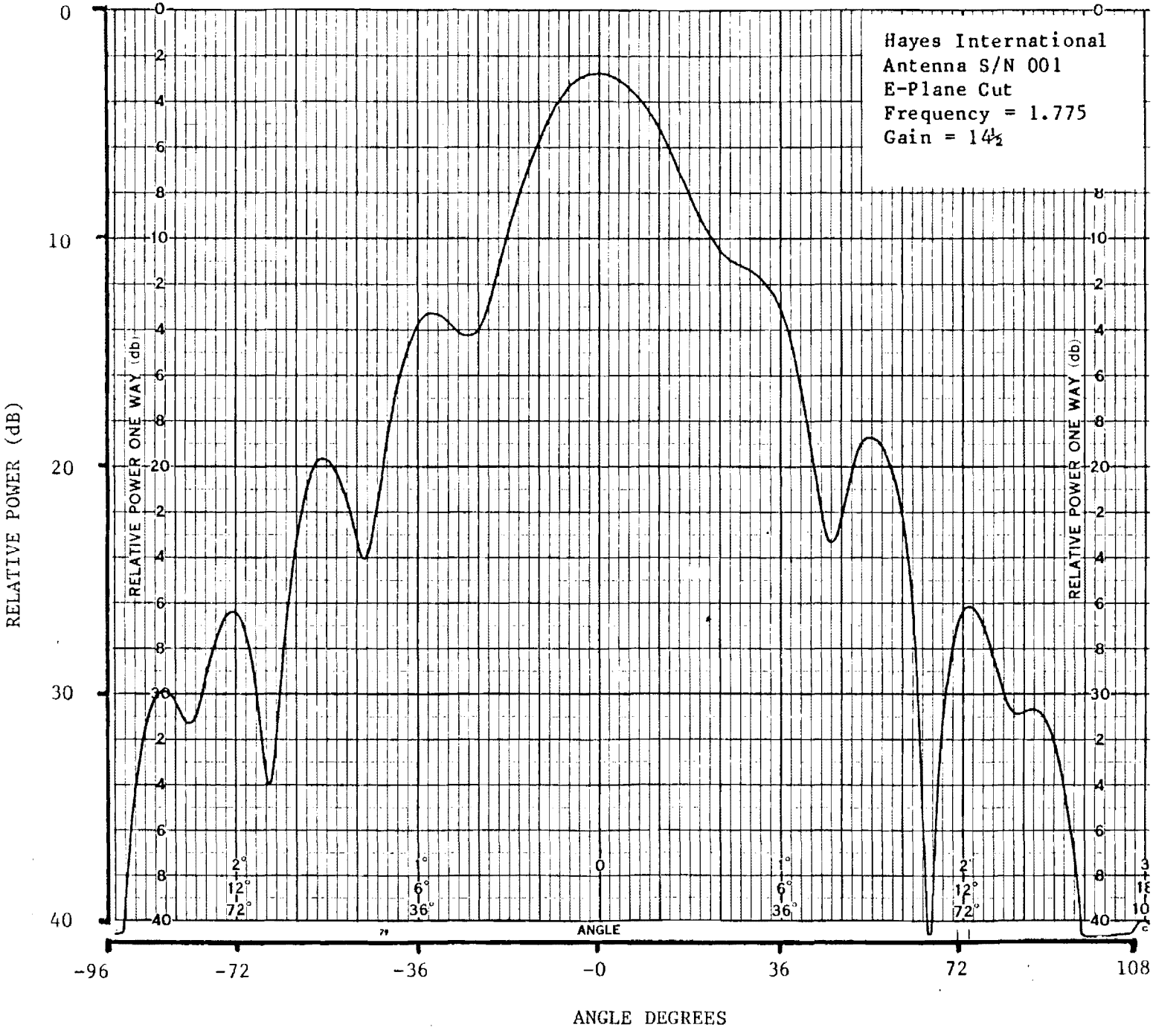


Figure 1. Antenna pattern for the Hayes S/N 001 antenna (continued).

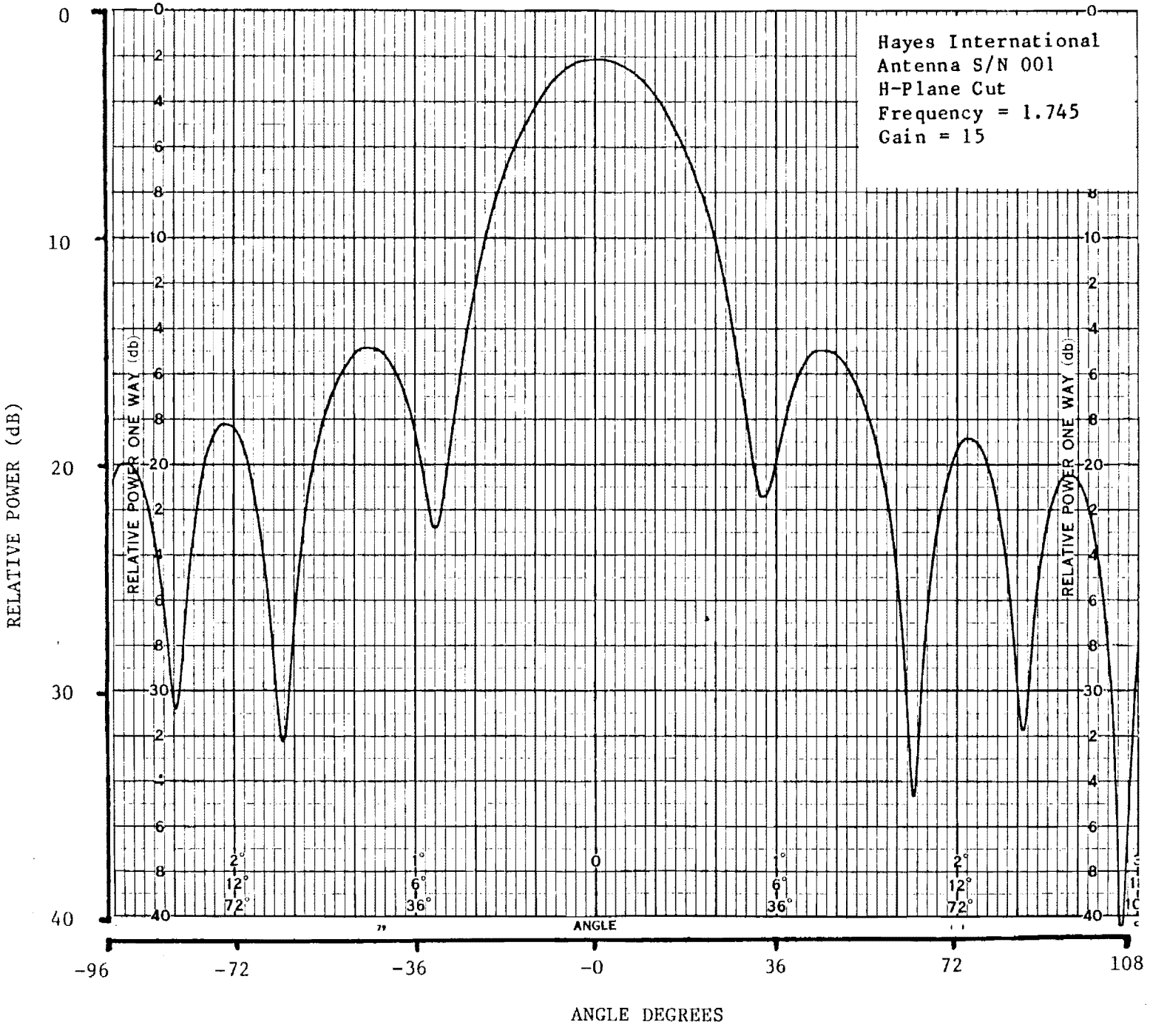


Figure 1. Antenna pattern for the Hayes S/N 001 antenna (continued).

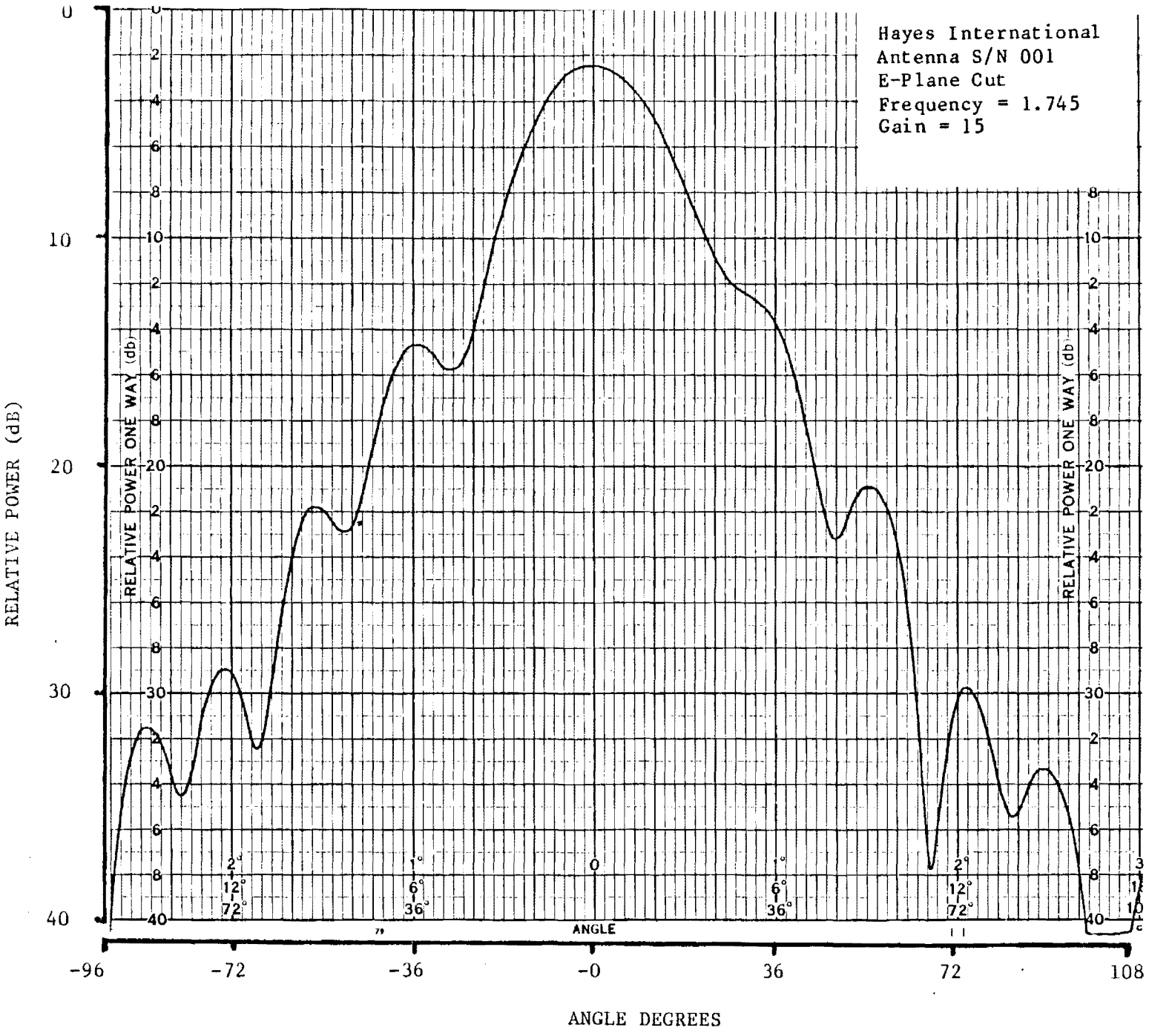


Figure 1. Antenna pattern for the Hayes S/N 001 antenna (continued).

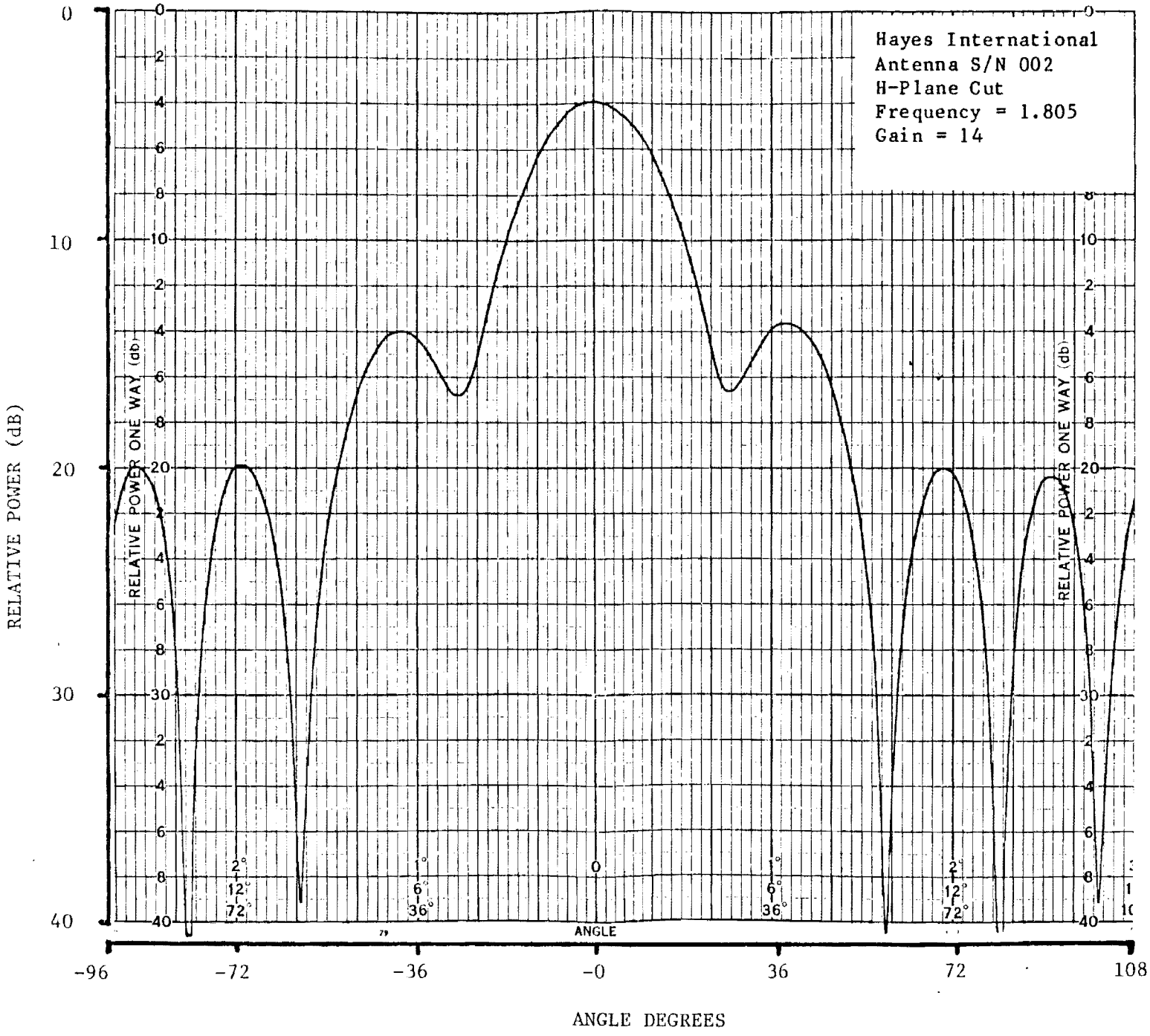


Figure 2. Antenna pattern for the Hayes S/N 002 antenna.

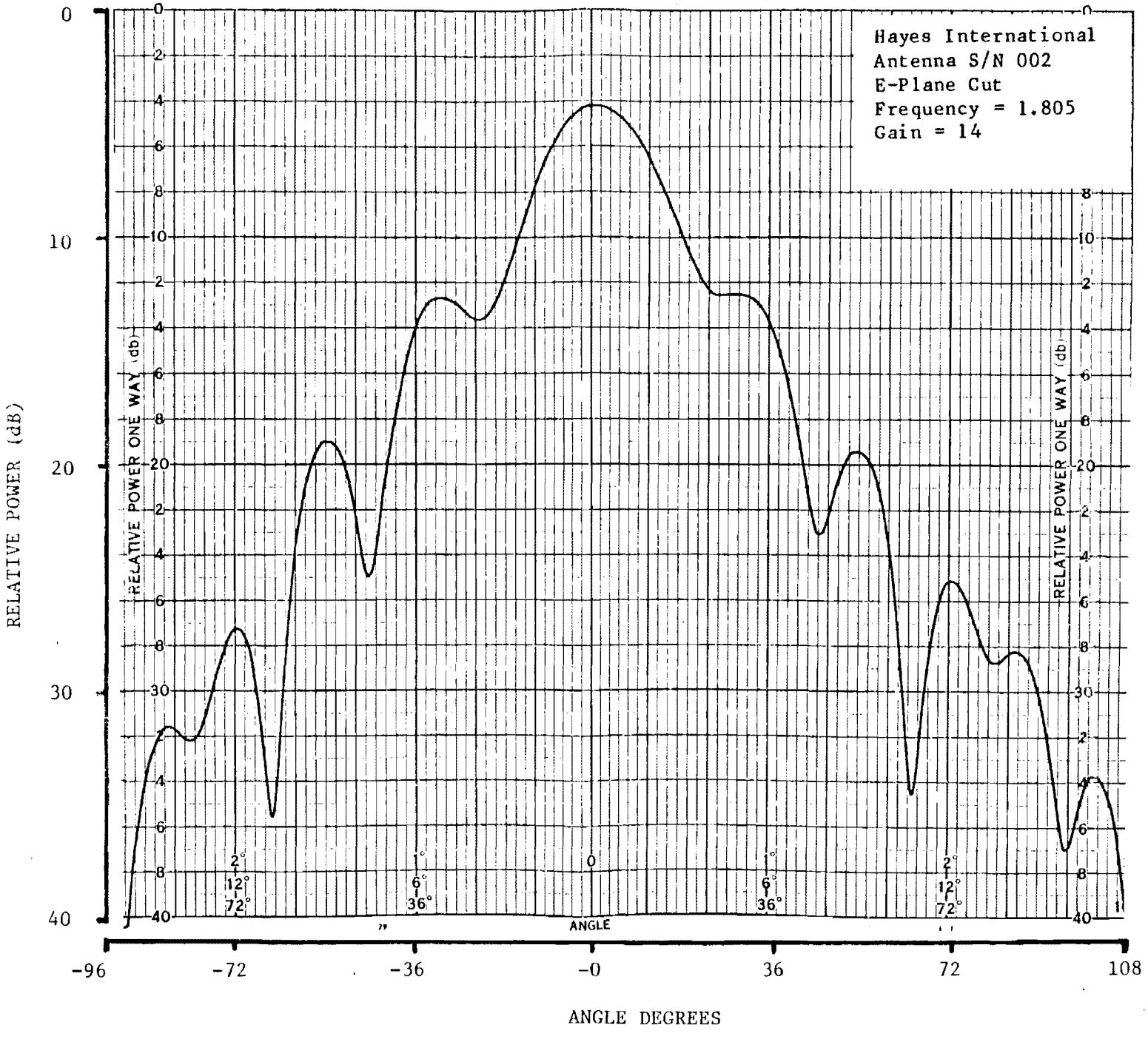


Figure 2. Antenna pattern for the Hayes S/N 002 antenna (continued).

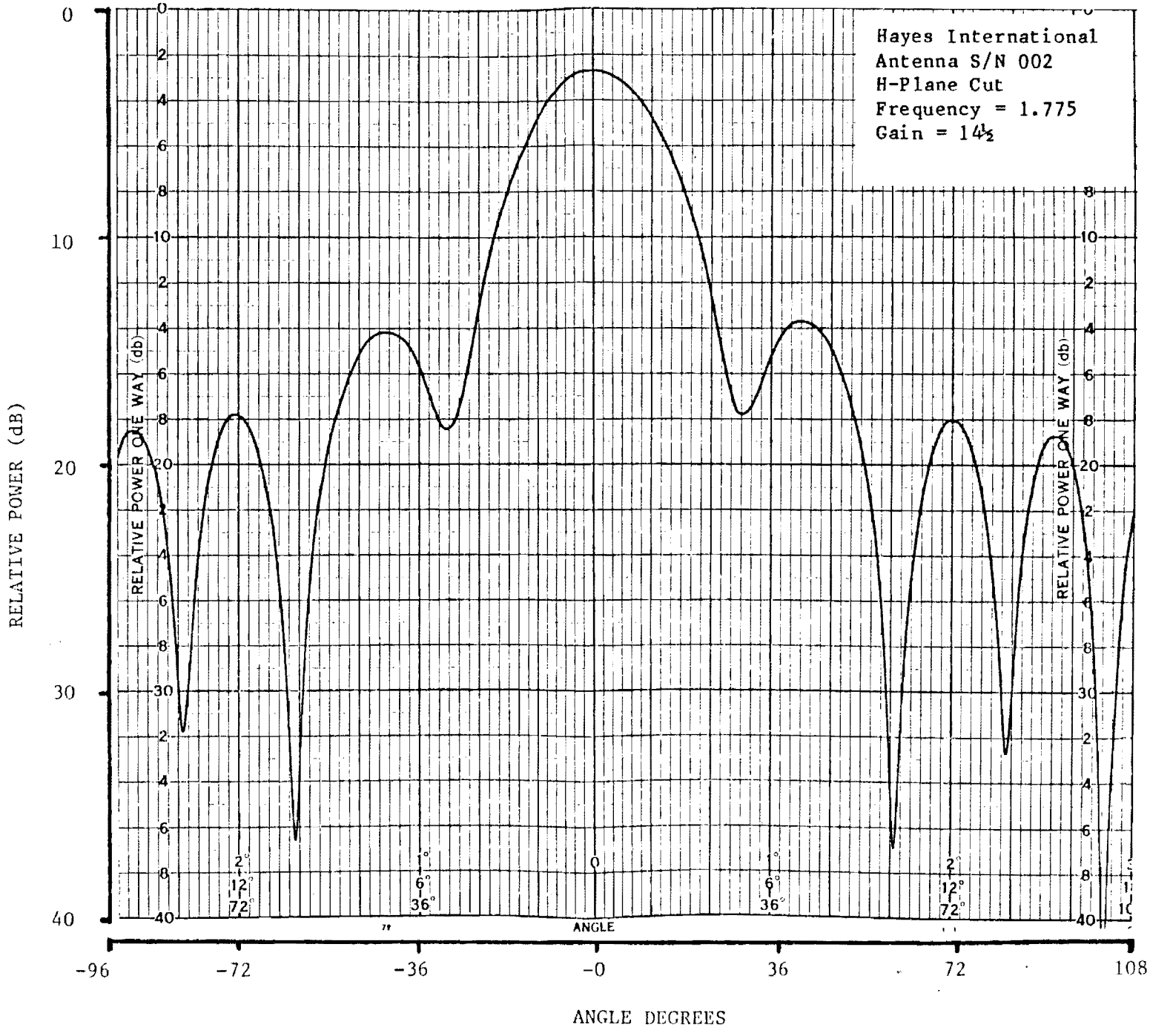


Figure 2. Antenna pattern for the Hayes S/N 002 antenna (continued).

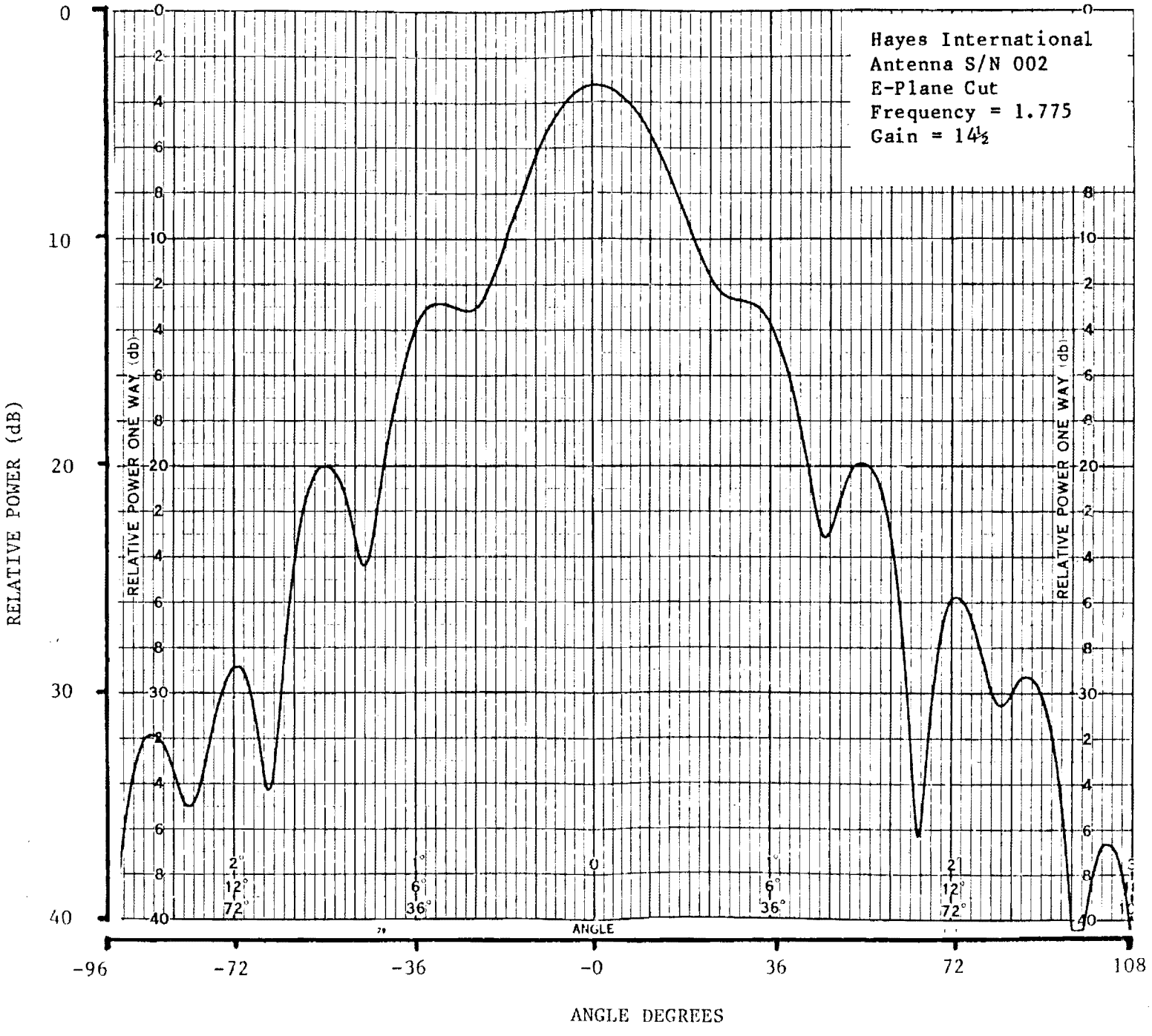


Figure 2. Antenna pattern for the Hayes S/N 002 antenna (continued).

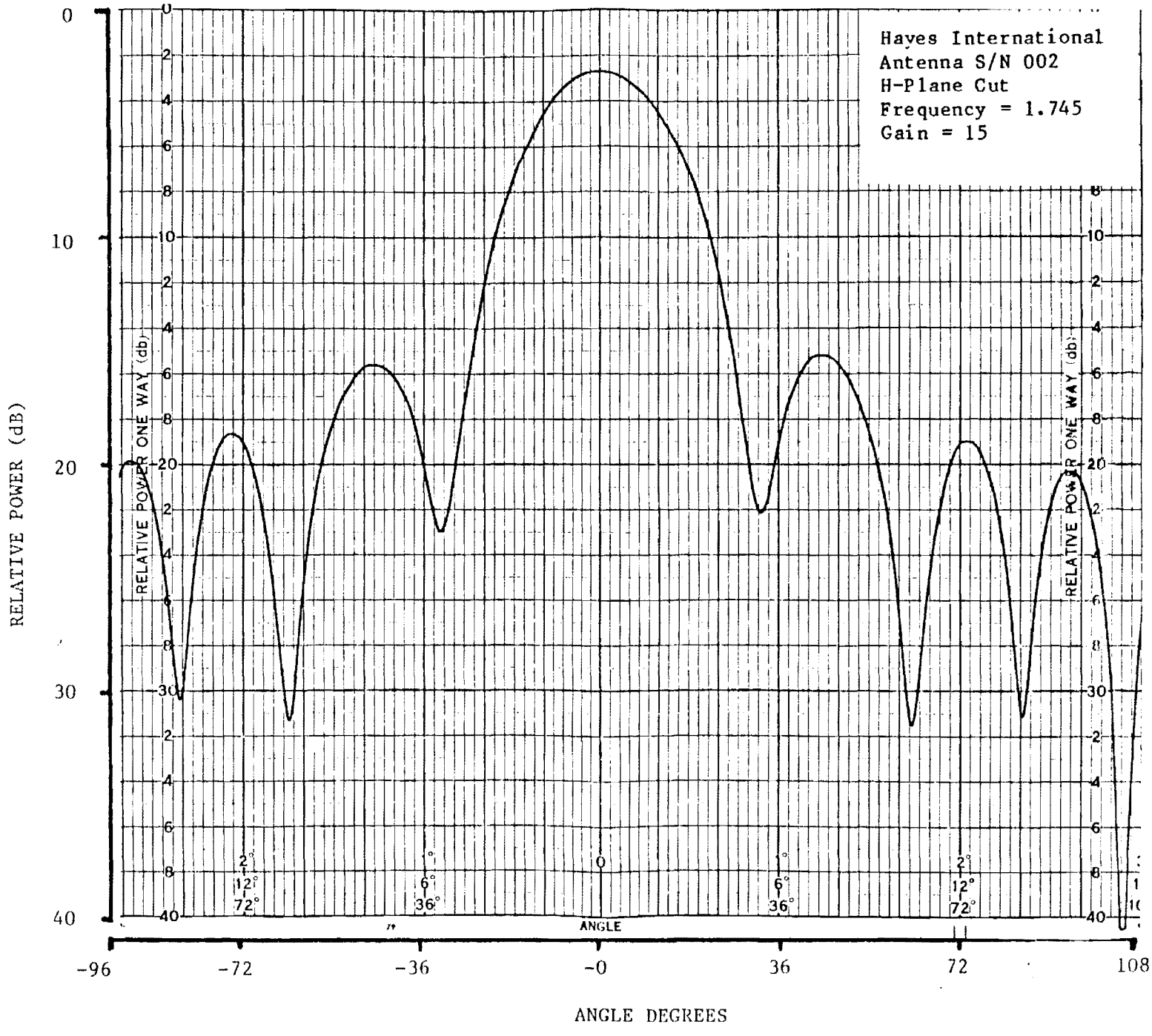


Figure 2. Antenna pattern for the Hayes S/N 002 antenna (continued).

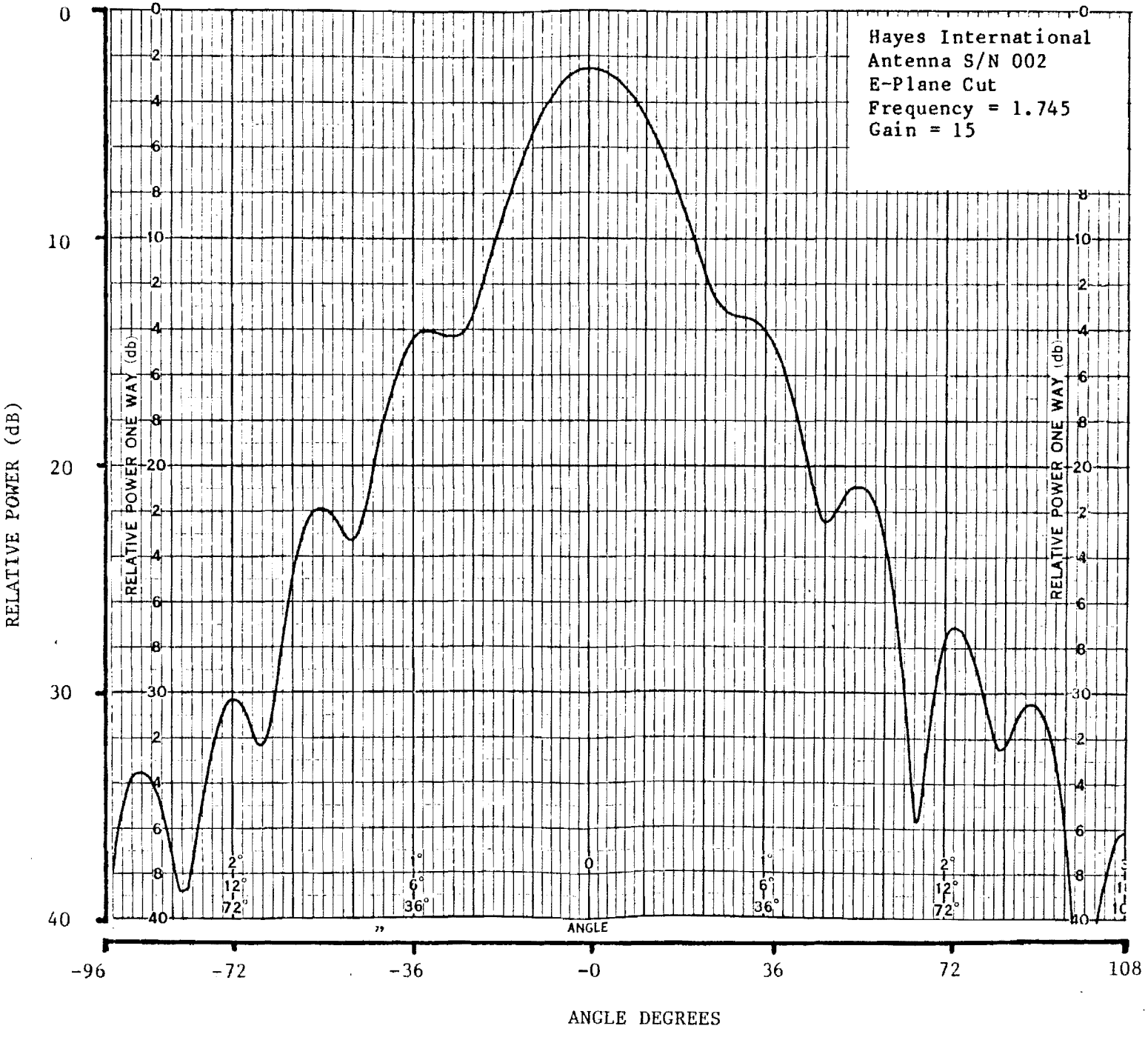


Figure 2. Antenna pattern for the Hayes S/N 002 antenna (continued).

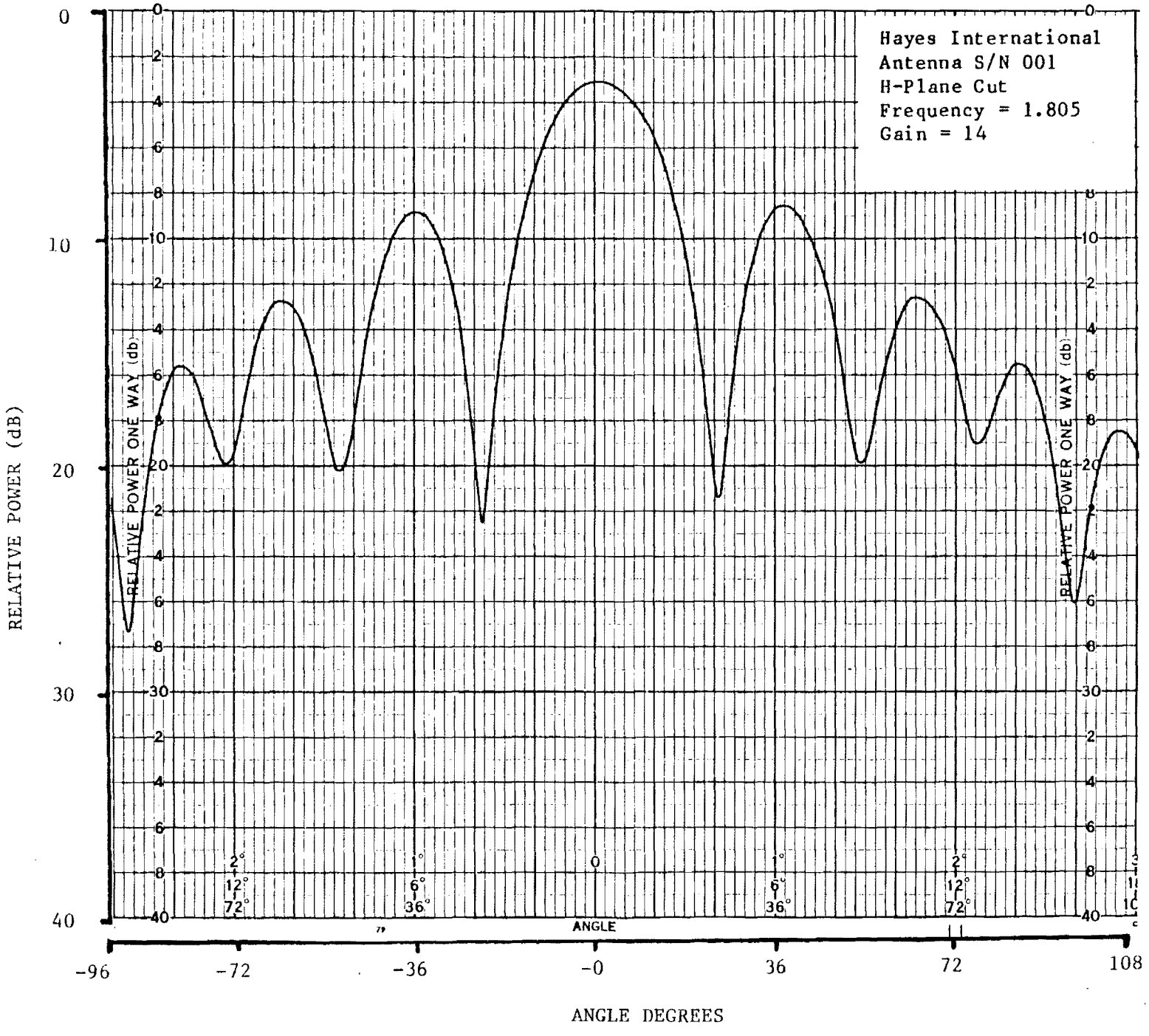


Figure 3. Antenna pattern for the Hayes S/N 001 antenna operating without side reflectors.

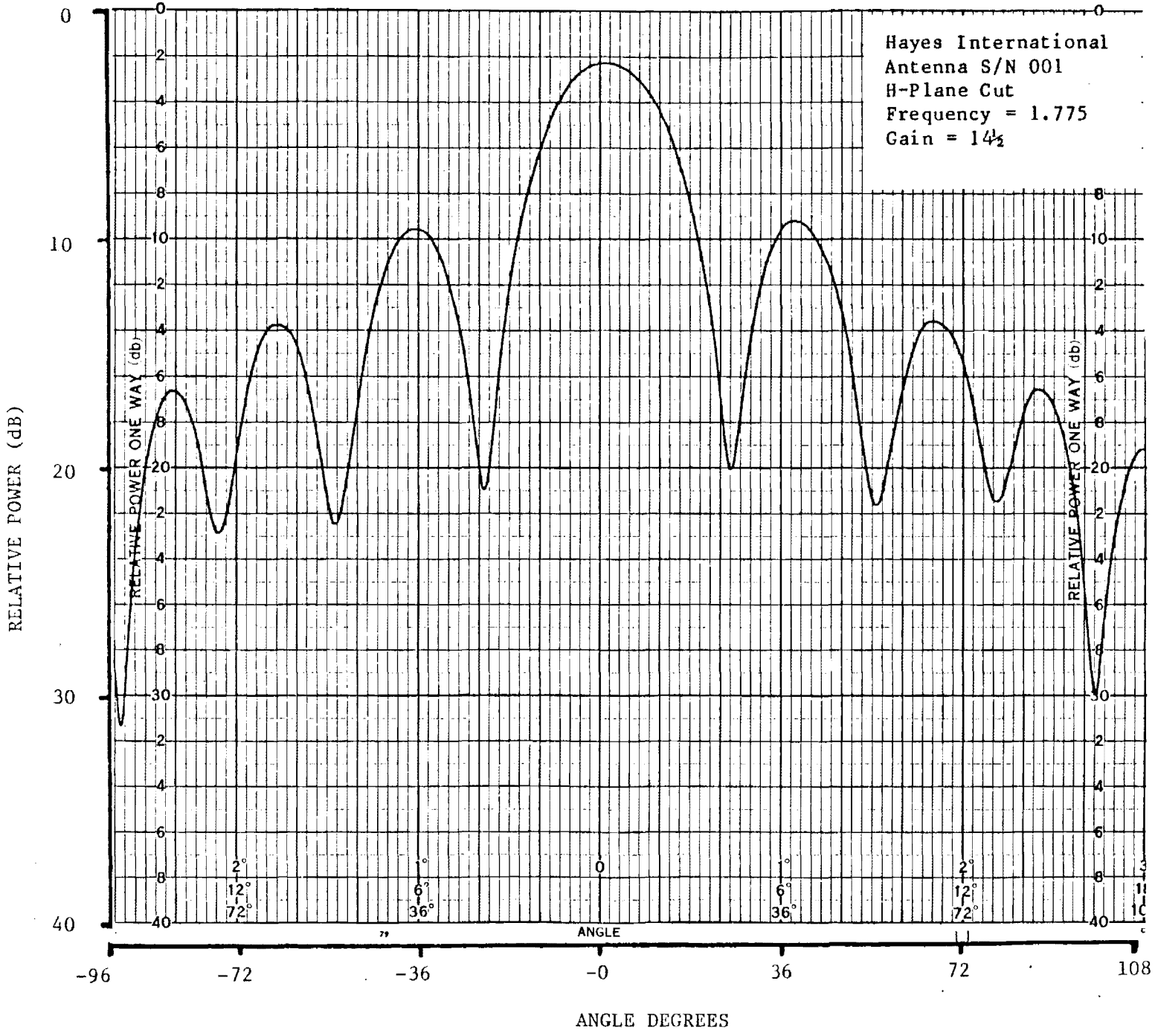


Figure 3. Antenna pattern for the Hayes S/N 001 antenna operating without side reflectors (continued).

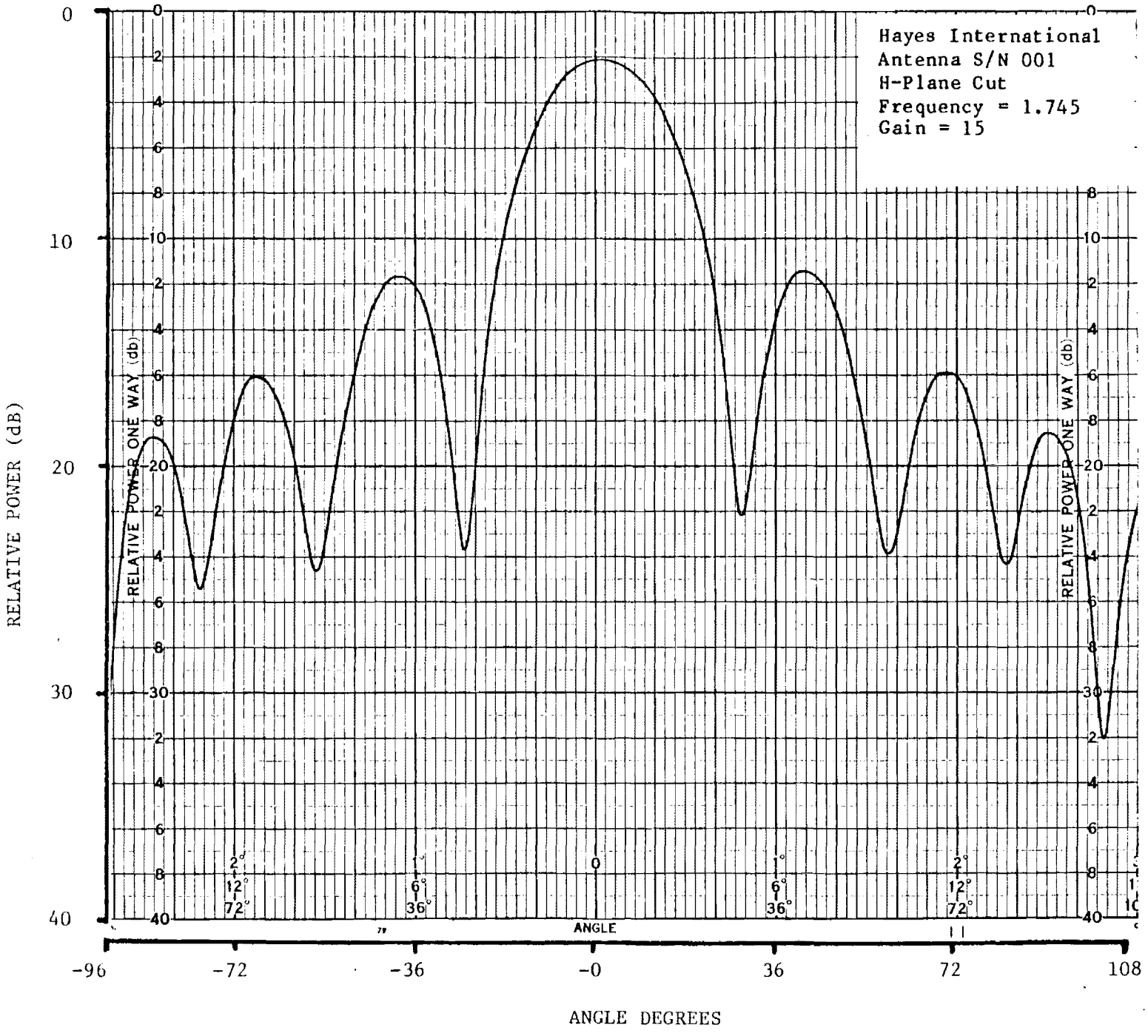


Figure 3. Antenna pattern for the Hayes S/N 001 antenna operating without side reflectors (continued).

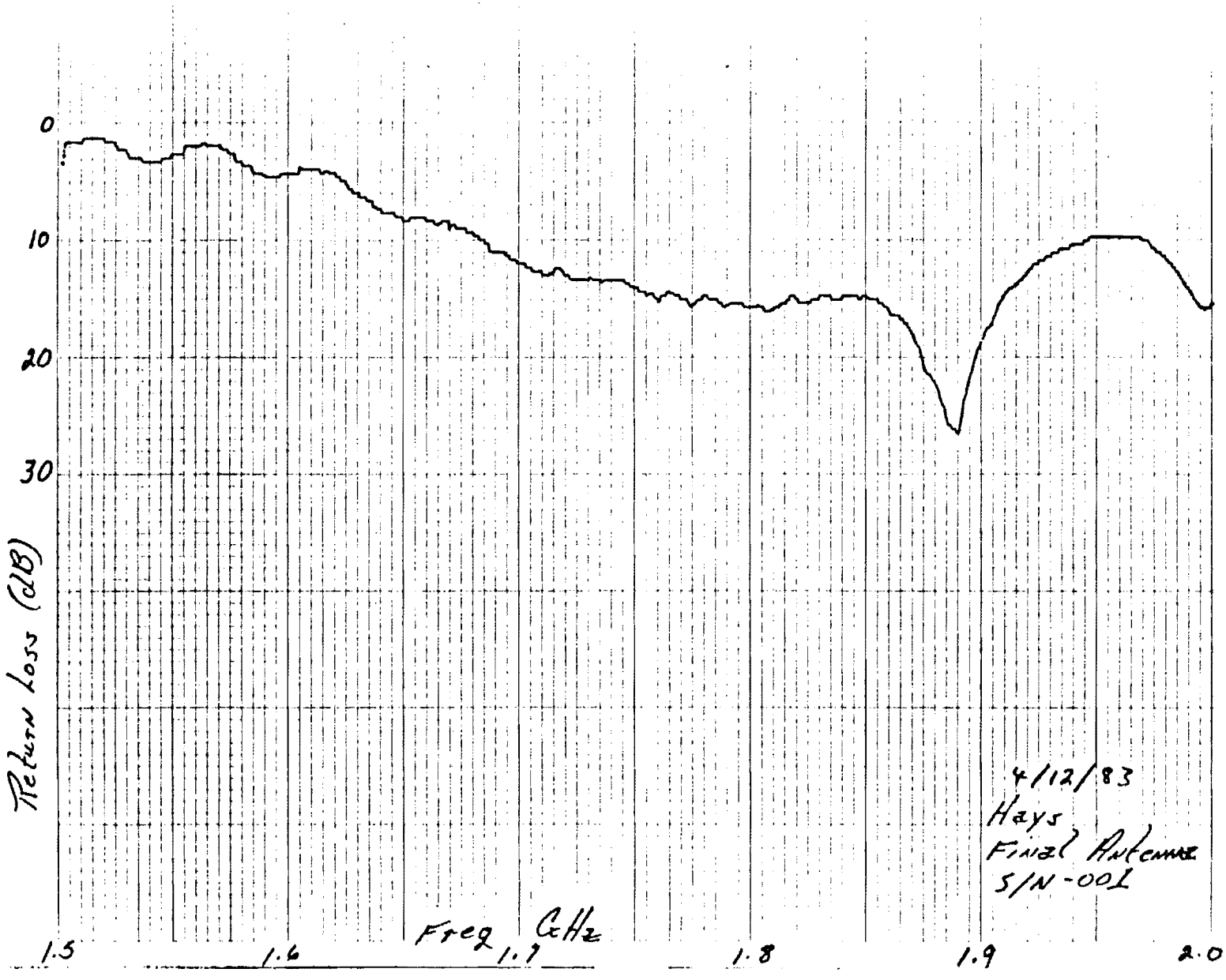


Figure 4. Reflected power graph for the Hays S/N 001 antenna.

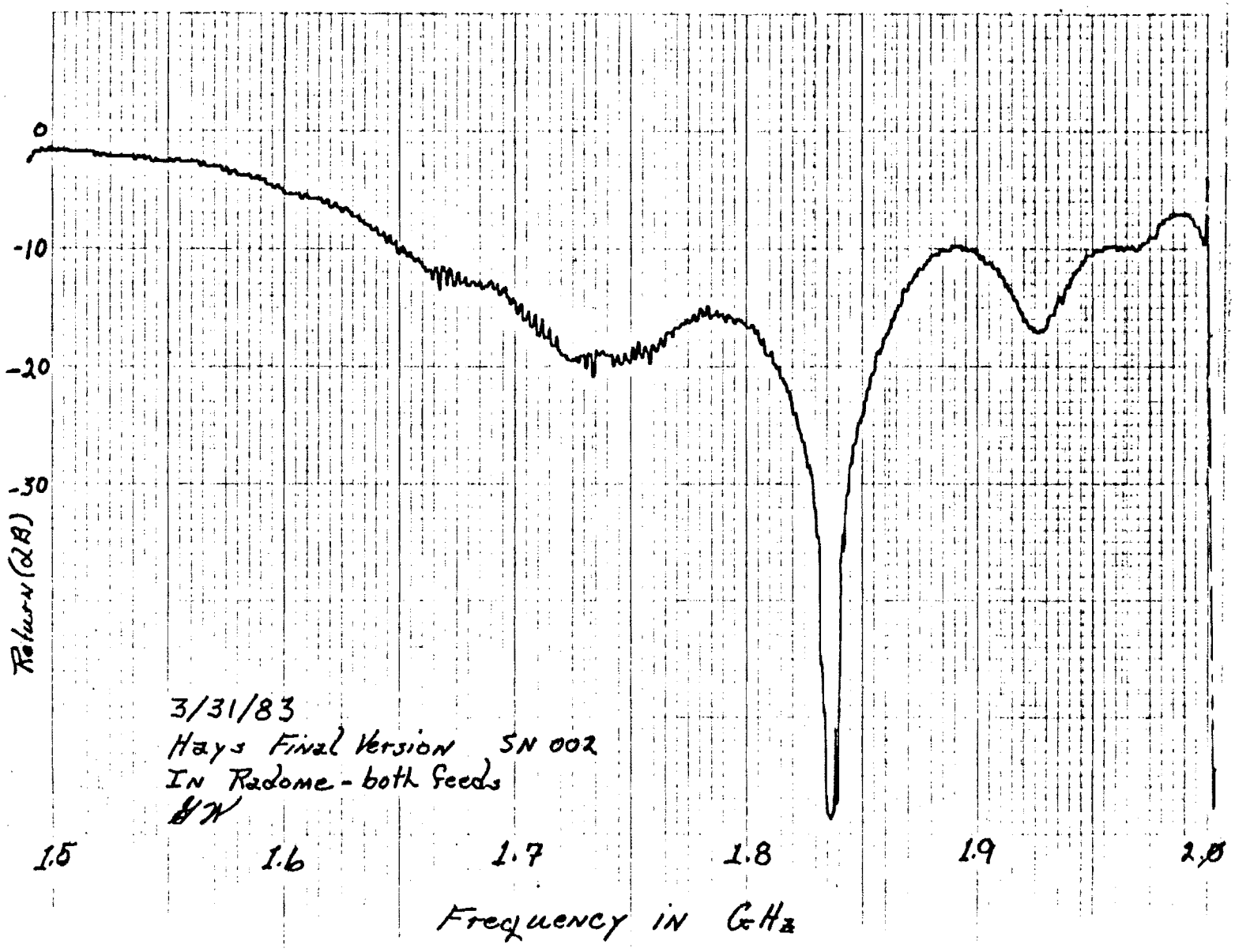


Figure 5. Reflected power graph for the Hays S/N 002 antenna.